

# HOW TO MIX CONCRETE



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“Chicago AA” Book No. 12

# How to Mix Concrete

*By*  
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*and*  
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Reprint from Bulletin No. 20, published by the  
American Association of Portland Cement Manufacturers

Chicago Portland Cement Co.  
108 La Salle Street  
Chicago, Ill.

## USE "CHICAGO AA"

*Because it is used by  
the majority of*

Architects  
Civil and Mechanical Engineers  
Railways  
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Concrete-Block Manufacturers  
Cement Brick, and Tile Manufacturers  
Art Cement Workers

*and because*

"Chicago AA" Portland Cement

*is the*

Highest Quality

2



"THE BEST THAT CAN BE MADE"

# Introduction

With the rapid decrease of our timber supply, and the resulting increase in price of lumber, there has come a necessary demand for a new building material. Nowhere has this demand been felt more keenly than on the American farm, where lumber has been practically the only building material. However, on account of the farmer's nearness to the timber itself, he has been the last to feel the full effect of the shortage. Owing to the many idle hours on the farm, due to rainy days and the winter months, the farmer figures his labor at a very low price, when not spent in actual farm work. Therefore, as materials are practically the only costs figured, the doubling of lumber prices doubled the cost of the average farm building. The uses of brick and stone masonry were well known. But with bricks the whole material had to be manufactured at some distant kiln, shipped on the railroad, and hauled from the station, generally at a time when the roads were in the worst condition. Stone in the form of rubble masonry was used for foundations, but was too costly and cumbersome to be used above the ground. Accordingly the progressive, practical American farmer has hailed with delight the advent and rapid rise of the use of the new building material, concrete—a manufactured stone as durable as rock, stronger than brick or rubble stone masonry, adaptable to practically any form of building detail, and lastly, but far from least, CHEAP and FIRE-PROOF.

The adaptability of concrete as a building material is the one great characteristic which makes it possible to take advantage of its other characteristics in practically every form of construction. Concrete is to-day used to advantage in over two hundred and fifty different commercial forms, ranging from great engineering structures, containing thousands of cubic yards of material, to a concrete fence-post containing only one-twentieth of a cubic yard.

## PURPOSE

This bulletin is issued for the purpose of instructing the individual user, the practical man, who desires to take advantage of the utility of Portland cement concrete and yet has not the time to obtain a technical knowledge of this subject. This bulletin tells him what concrete is, how it can be made, and what he must not do if he is to meet with success. No attempt will be made to discuss reinforced concrete design, as that subject will be handled in subsequent bulletins on specific uses.

## WHAT CONCRETE IS

Concrete is the manufactured stone formed by mixing cement, sand, and stone or gravel (pebbles) together. Various proportions of each are used, depending upon the use to which the concrete is put. The mixture in which all the spaces (called voids) between the stone or gravel are filled with sand and all the spaces between the sand are filled with cement is the ideal mixture. This mixture is rarely obtained, as the voids in each load of gravel and sand vary slightly, and in order to be absolutely safe a little more sand and a little more cement than will just fill the voids are used.

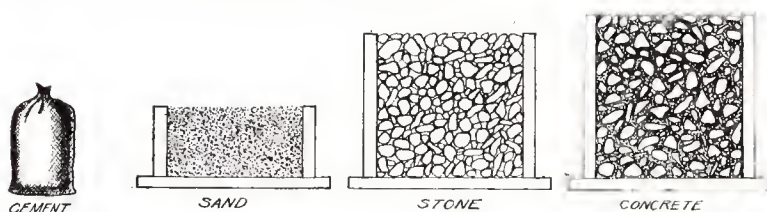


Fig. 1.—Quantities of cement, sand, and gravel in 1:2:4 concrete mixture and the resulting quantity of concrete, which is only slightly greater in size than the gravel; the sand and cement filling the voids in the gravel.

TABLE I

Showing the Quantities of Materials and the Resulting Amount of Concrete for Two-Bag Batch.

KIND OF CONCRETE MIXTURE	PROPORTIONS BY PARTS			TWO-BAG BATCH						
	Cement	Sand	Stone or Gravel	Materials			Concrete	Size of Measuring Boxes		Water* in Gallons for Medium Wet Mixture
				Cement	Sand	Stone or Gravel		Sand	Stone or Gravel	
1 : 2 : 4 Concrete . .	1	2	4	Bags 2	Cu. Ft. 3¾	Cu. Ft. 7½	Cu. Ft. 8½	2'x2' 11½"	2'x4' 11½"	Gallons 10
1 : 3 : 6 Concrete . .	1	3	6	2	5¾	11 ½	12	2'x3' 11½"	3'x4' 11½"	13½

PROPORTIONS.—Table No. I shows the amount of stone, sand, and cement used in the various grades of concrete work. In explanation of the proportions, they are always measured by volume. A 1 : 2 : 4 mixture means one part cement, twice as much sand, and four times as much gravel, making the whole mixture consist of seven parts.

\*See note on WATER, next page



*Example:* Suppose in the Silo Bulletin, a 1:2:4 concrete mixture is specified. Then, under the heading “Kind of Concrete Mixture,” take the line marked 1:2:4 Concrete, and running to the right across the page, all the quantities of materials can be found. Under the “Proportion by Parts” it can be seen that there is one part cement, two parts sand, and four parts stone or gravel, and this is the mixture specified. Then, running farther across the page are found the quantities of cement, sand, and stone or gravel under their respective headings, to be mixed together in a two-bag batch. There are two bags of Portland cement,  $3\frac{3}{4}$  cubic feet of sand, and  $7\frac{1}{2}$  cubic feet of stone or gravel. Under the next column the quantity of concrete resulting from the above mixture is found to be  $8\frac{1}{2}$  cubic feet. Under “Size of Measuring Boxes” it is found that the sand should just fill a box 2 feet wide by 2 feet long by  $11\frac{1}{2}$  inches deep, and the stone or gravel a box 4 feet long by 2 feet wide by  $11\frac{1}{2}$  inches deep. The next column gives 10 gallons as the amount of water to be used as a trial in mixing the first batch.

*How Quantities are Measured.*—One barrel of Portland cement contains 3.8 cubic feet of packed cement or one bag of cement ( $\frac{1}{4}$  barrel) contains 0.95 cubic feet.

Sand and stone (or gravel) are measured loose in the boxes. Do not pack them.

*Two-Bag Batch.*—A two-bag batch of concrete requires two bags of cement, the sand and stone or gravel being proportioned accordingly as shown. For a four-bag batch, multiply the amount of stone and gravel by two, double the cubic contents of the measuring boxes, and use four bags of cement.

*Measuring Boxes.*—The inside dimensions for the measuring boxes for sand and stone or gravel are given. These boxes can be made of any kind of rough boards and have no top or bottom. (See Fig. 3.)

*Water.*—The amount of water given is only approximated. Use this amount for the first batch; if too wet for the use desired, reduce the amount used; if too dry, increase the amount. Always use a bucket in measuring amount of water, as this secures uniform results. See heading “Consistency,” on page 22, for proper wetness of concrete.

*The Amount of Concrete.*—The less the voids in stone or gravel,

the greater will be the volume of the concrete. In general, the amount of concrete will be greater than shown in Table No. I, especially when gravel is used.

*1 : 2 : 4 Concrete.*—A very strong mixture used for all kinds of reinforced concrete, such as floors, beams, girders, columns, etc., subjected to very heavy loading or vibrating machinery, is water-proof and air-tight when used on the farm for silos, tanks, cisterns, fence-posts, troughs, culverts, building walls, etc.

Proportion 1 : 2 : 4 means the concrete mixture is made up of one barrel (four bags) packed cement, two barrels ( $7\frac{1}{2}$  cubic feet) loose sand, and four barrels (15 cubic feet) loose stone or gravel.

*1 : 3 : 6 Concrete.*—A strong mixture, but of less strength than 1 : 2 : 4 concrete, sometimes used for reinforced concrete in floors and walls, but more generally used without reinforcement in foundations, footings, ground floors, sidewalks, gutters, etc.

Proportion 1 : 3 : 6 means that the concrete mixture is made up of one barrel (four bags) packed cement, three barrels ( $11\frac{1}{2}$  cubic feet) loose sand, and six barrels (23 cubic feet) loose stone or gravel.

*Cautions for Variations in Mixture.*—If sand is very fine, increase the cement 10 per cent to 15 per cent.

If the mixture looks streaky, and does not have a uniform color, it is not fully mixed.

If the mixtures does not work well, the sand and cement not filling the voids in the stone, reduce the percentage of stone slightly, but first be sure the concrete is properly mixed. Half-mixed concrete may present features that are entirely eliminated by turning it over once or twice more.

### THE MATERIALS TO USE

**CEMENT.**—Portland cement is a manufactured product, the principal value of which is its ability to adhere to the various materials used in masonry construction.

On adding water to the dry cement until the whole becomes a soft, sticky paste, the cement is in a plastic state, and will remain so for about one-half hour, depending somewhat upon the temperature of the air. It then begins to harden or "set." To disturb the concrete after this initial set has started means a decided loss in strength. To disturb it after this initial set is well under way means to DESTROY the concrete.



*So remember that:* Cement must be placed in position within twenty or thirty minutes from the time it is first wet.

There are several other minor considerations which should be observed, as follows:—

1. The binding value of cement is lowered by exposing it to a hot sun during the first four or five days after it has been placed.
2. A green cement mixture can be easily frozen at a temperature below 32 degrees Fahrenheit, and should not be allowed to freeze if possible. Frozen cement requires the greatest care in handling. Freezing does not materially affect the binding quality of good Portland cement, provided it is in no way disturbed after placing or subjected to any load until after it has been thawed out and allowed to set in the usual way. It is safest to avoid mixing on days when the temperature is below 32 degrees Fahrenheit (freezing). In no case should fresh manure be placed over very green concrete to protect it from freezing, as this will spoil the surface of the concrete.

*How Portland Cement Comes.*—Portland cement comes in paper bags, cloth sacks, or wooden barrels. The best way to handle it for the average user is in cloth sacks. The manufacturers charge more for this kind of a package, but allow a discount for the return of the empty bags. The bags must be kept dry and untorn, and shipped back by freight, in exact accord with the requirements of the cement company. Paper bags tear too easily and cause a big percentage of loss, especially on small jobs where any carrying has to be done. Barrels are too bulky to handle easily and are too large a unit for measuring. The weight of the shipping units of cement varies slightly, but in general a paper or cloth bag contains 95 pounds of cement, and four such bags make a barrel of 380 pounds.

*Where to Buy Cement.*—Cement is manufactured in twenty-five States in the United States. The supply man in the nearest town will certainly handle at least one brand of good Portland cement. Insist on getting Portland cement. There are other kinds made, but Portland cement is *the best*.

*How to Keep Portland Cement.*—Cement must be stored in a dry place. It absorbs moisture from the atmosphere with great readiness, and soon becomes lumpy, or even a solid mass, when kept in a damp place. Such cement is useless and must be thrown away.

Lumpy cement should not be broken up and used again, even if this can be readily done, as it has lost by far the greater part of its adhesive value. In storing cement, throw wooden blocks on the floor, place boards over them, and pile the cement on the boards, as shown in Fig. 2, covering the pile with a canvas or piece of roofing paper.

**SAND.**—Sand should be clean, coarse, and free from loam, clay, and all vegetable matter.

*Cautions.*—Do not use very fine sand. It will not make as strong



Fig. 2—Cement Stored and Ready for Use.

concrete as coarse sand. If there is a large quantity of fine sand handy, get a coarse sand and mix the two sands together in equal parts; this mixture is as good as coarse sand alone. If the sand is not clean, wash it before using. The simplest way is to build a loose board platform from 10 to 15 feet long, with one end 12 inches higher than the other. On the lower end and on the sides nail a 2x6 on edge to hold the sand. Spread the sand in a layer over the platform 3 or 4 inches thick and wash with a  $\frac{3}{4}$ -inch garden hose. The washing should be started at the high end and the

water allowed to run through the sand and over the 2-inch x 6-inch piece at the bottom. A small quantity of clay or loam does not injure the sand, but any amount over 5 per cent should be washed out.

*Remember*, if fine, dirty sand is used, the strength of the concrete will be limited by the strength of the sand and only a part of the full value of the Portland cement will be developed.

STONE OR GRAVEL.—The largest part of the concrete is the crushed stone or gravel (pebbles, as they are often called). Other materials are sometimes used in place of stone or gravel, such as ashes, cinders, coke, brick-bats, etc., but it is safer to use crushed stone or gravel. The stone or gravel should be clean: that is, free from loam, clay, or vegetable matter. Especial care should be taken to inspect the pebbles, as often clay is deposited in a thin layer on their surface and this layer prevents the binding of the cement. Gravel can be washed in the same way as sand, but more easily, as the water flows through the larger voids in the gravel more readily than through the voids in the sand. Dust may be left in the crushed stone, but care should be taken to distribute it evenly throughout the whole mass.

*Size*.—The proper size of stone (or gravel) varies with the form of construction. Use anything up to  $2\frac{1}{2}$  inches in diameter for foundations or large thick structures. Use  $1\frac{1}{2}$  inches and under (generally about  $\frac{3}{4}$  inch), graded, for thin walls and reinforced concrete. Use  $\frac{1}{2}$  inch and under for a finish or very hard coating. The best results are obtained from a mixture of sizes graded from the largest to the smallest. This reduces the spaces or voids between the stones or pebbles and makes a more compact concrete. It also requires less sand and less cement.

WATER.—Water for concrete should be clean and free from strong acids and alkalies. It can be readily stored in a barrel beside the mixing-board and placed on the concrete with a bucket, as this allows careful measurement and insures the desired wetness of the mixture.

NATURAL MIXTURE OF BANK SAND AND GRAVEL.—Naturally mixed bank sand and gravel are sometimes found in the right proportions for making concrete. Generally, however, there is far too much sand for the gravel, and great care should be exercised in using this class of material. Unless the mixture runs very even

throughout the bank, and is found to be made up of one part sand to two parts gravel, it is better to screen the sand out of the gravel and prepare the materials in the usual way.

Below is a table showing the quantities for a natural mixture of bank sand and gravel. The quantities can be found in the same way as in Table I, on page 4.

TABLE II

Showing the Quantities of Materials and the Resulting Amount of Concrete for Two-Bag Batch, Using Natural Mixture of Bank Sand and Gravel.

KIND OF CONCRETE MIXTURE	PROPORTIONS BY PARTS			TWO-BAG BATCH FOR NATURAL MIXTURE OF BANK SAND AND GRAVEL				
	Cement	Sand	Stone	Materials		Concrete	Size of Measuring Boxes	Water in Gallons for Medium Wet Mixture
				Cement	Natural Mixture of Sand and Gravel		Mixture of Sand and Gravel	
				Bags	Cu. Ft.	Cu. Ft.		Gallons
1 : 2 : 4 Concrete.....	1	2	4	2	7 1/2	8 1/2	2' x 4' x 11 1/2"	10
1 : 3 : 6 Concrete.....	1	3	6	2	11 1/2	12	3' x 4' x 11 1/2"	13 1/2

### HOW TO MIX CONCRETE

With the proper materials selected, the next step is to mix properly and with dispatch. On large jobs it is more economical to mix concrete by machine, but for small jobs, using even as much as several hundred cubic yards of concrete, it is much cheaper and more expedient to mix by hand. This is, of course, especially true when only two or three men are available and the work is often interrupted. There are many ways of "hand mixing," all having the same good results. The way described here we believe to be the one best calculated to obtain good results with a minimum of labor. In this description and the accompanying illustrations, we have taken as a basis a "Two-Bag Batch" of 1 : 2 : 4 concrete.

### CONCRETE BOARD

A concrete board for two men should be 9 feet x 10 feet. Make it out of 1-inch boards, 10 feet long, surfaced on one side, using 5 2-inch x 4-inch x 9-foot cleats to hold them together. If 1-inch x 6-inch tongue-and-groove roofers can be obtained, they will do very nicely if fairly free from knots. The object of the surfaced boards is to make the shoveling easy. The boards are so laid as to enable the shoveling to be done with, and not against, the cracks

between the boards. The boards must be drawn up close in nailing so that no cement grout will run through while mixing. Knot-holes may be closed by nailing a strip across them on the under side of the board. It is a good precaution against losing cement grout to nail a 2-inch x 2-inch or 2-inch x 4-inch piece around the outer edge of the board. Often 2-inch planks are used in making concrete boards, but these are unnecessarily heavy and very cumbersome to move. (See Fig. 3.)

*Placing the Concrete Board.*—The concrete board is a manufacturing plant, and the advantages of its location should be carefully considered. Generally it is best placed as close as possible to the forms in which the concrete is to be deposited, but "local conditions" must govern this point. Pick a place giving plenty of room, near the storage piles of sand and stone (or pebbles). Block up your concrete board level, so that the cement grout will not run off on one side, and so that the board will not sag in the middle under the weight of the concrete.

### RUNS

Do not use any old boards that are handy for the wheelbarrow runs. Make a good run, smooth, and at least 20 inches wide if much above the ground. It is surprising how this one feature will lighten and quicken the work.

### TOOLS AND PLANT

List of tools and plant to be used in mixing, giving sizes, quantities, etc.

*Concrete Board for 2-Bag Batch, 9' x 10' in size.*

9 pcs.  $\frac{7}{8}$ " x 12" x 10', surfaced one side and two edges. (Any width of plank may be used; 12" is specified only for convenience.)

5 pcs. 2" x 4" x 9' rough.

2 pcs. 2" x 2" x 10' rough.

2 pcs. 2" x 2" x 9' rough.

*Concrete Board for 4-Bag Batch, 12' x 10' in size.*

12 pcs.  $\frac{7}{8}$ " x 12" x 10', surfaced one side and edges. (Any width of plank may be used; 12" is specified only for convenience.)

5 pcs. 2" x 4" x 12' rough.

2 pcs. 2" x 2" x 10' rough.

2 pcs. 2" x 2" x 12' rough.

*Runs.*—2", 2½", or 3" plank 10" or 12" wide.

*Measuring Boxes for Sand and Stone or Gravel.*

For 2-Bag Batch 1 : 2 : 4 Mixture:

4 pcs. 1" x 11½" x 2' rough.

2 pcs. 1" x 11½" x 4' rough.

2 pcs. 1" x 11½" x 6' rough.

Note: The 2 pcs. 4' long and the 2 pcs. 6' long have an extra foot in length at each end to be made into a handle, as shown in Fig. 3.



For 2-Bag Batch 1:3:6 Mixture:

2 pcs. 1"  $\times$  11½"  $\times$  2'.

2 pcs. 1"  $\times$  11½"  $\times$  3'.

2 pcs. 1"  $\times$  11½"  $\times$  5'.

2 pcs. 1"  $\times$  11½"  $\times$  6'.

Note: The 2 pcs. 5' long and the 2 pcs. 6' long have an extra foot in length at each end to be made into a handle, as shown in Fig. 3.

For 4-Bag Batch:

Double cubic contents of boxes and order lumber accordingly.

*Shovels*.—No. 3 square point.

*Wheelbarrows*.—At least two necessary for quick work: sheet-iron body preferred.

*Rake*.

*Water-Barrel*.

*Water-Buckets*.—2-gallon size.

*Tamper*.—4"  $\times$  4"  $\times$  2' 6", with handles nailed to it, as shown in Fig. 3.

*Garden Spade or "Spading" Tool*, as shown in Fig. 15; also shown in Fig. 3, in the hands of the man on the concrete board.

*Sand Screen*.—Made by nailing a piece of ¼" mesh wire screen 2½'  $\times$  5' to a frame made of 2"  $\times$  4".

## MIXING

With the mixing-board placed and the "runs" made the concrete plant is ready.

First load your sand in wheelbarrows from the sand pile, wheel on to the "board," and fill the sand-measuring box, which is placed about 2 feet from one of the 10-foot sides of the board, as shown by the dotted lines in Fig. 4. When the sand box is filled, lift it off and spread the sand over the board in a layer 3 inches or 4 inches thick, as shown in Fig. 5. Take the two bags of cement and place the contents as evenly as possible over the sand. (See Fig. 5.) With the two men at points marked "x" and "xx" on the sketch below Fig. 5 start mixing the sand and cement, each man turning over the half on his side of the line A..A. Starting at his feet and shoveling away from him, each man takes a full shovel-load, turning the shovel over at the points marked 1 and 2 respectively in Fig. 5. In turning the shovel, do not simply dump the sand and cement at the points marked 1 and 2, but shake the materials off the end and sides of the shovel, so that the sand and cement are mixed as they fall. This is a great assistance in mixing these materials. In this

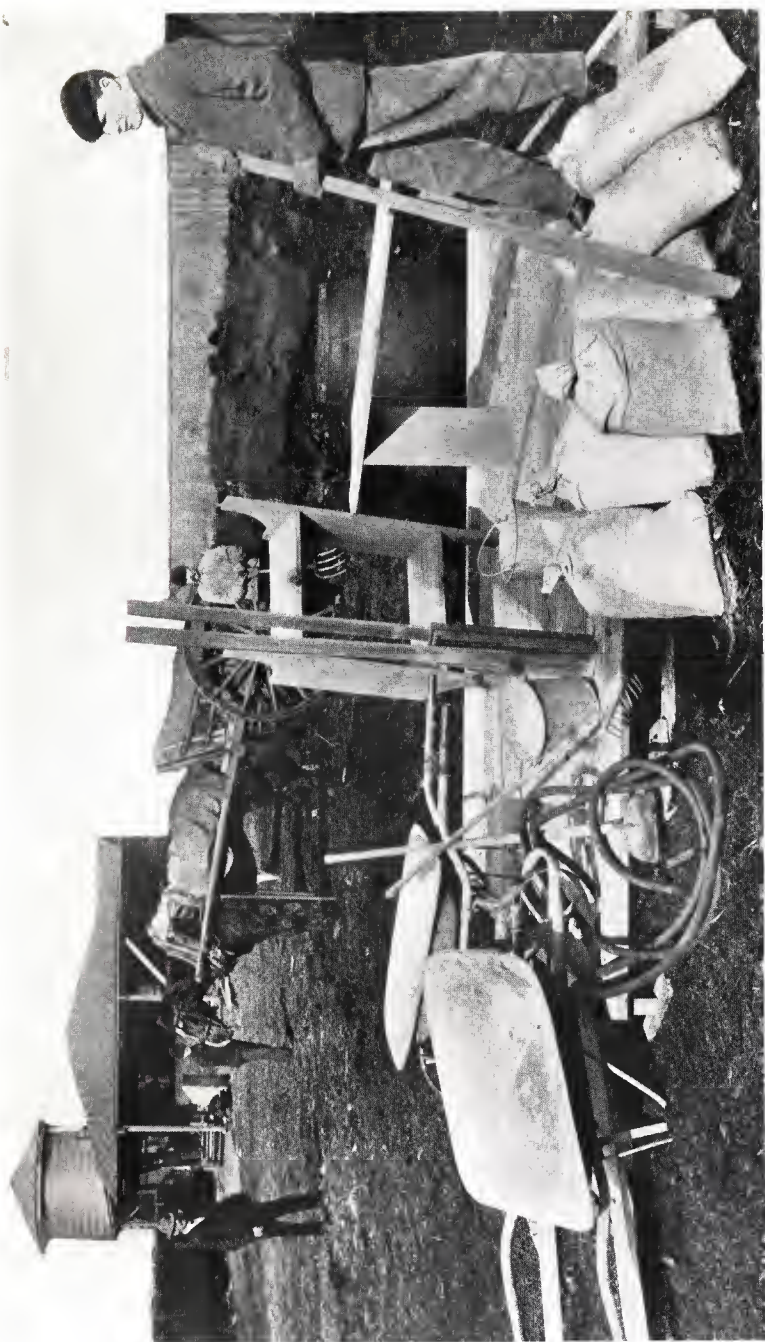


Fig. 3.

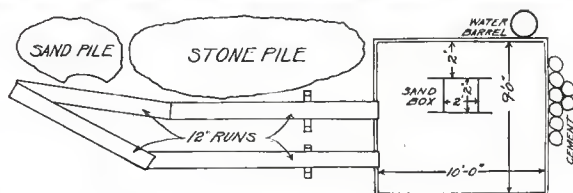
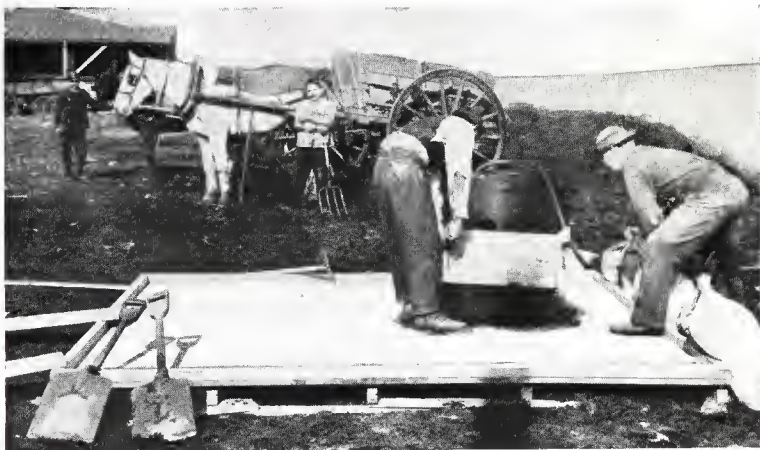


Fig. 4—Lifting off the Sand-Measuring Box and Getting Cement Ready.

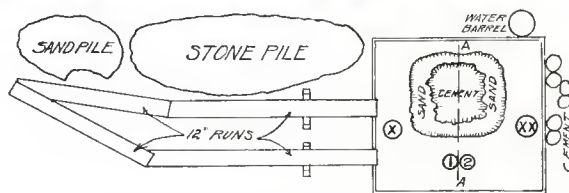


Fig. 5—Spreading the Cement over the Sand.



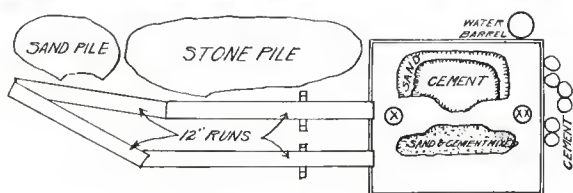


Fig. 6—First Turning, Sand and Cement.

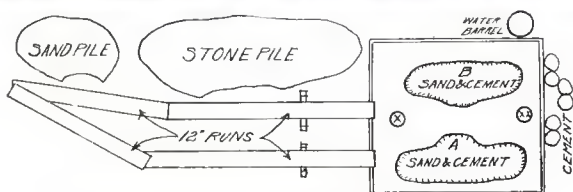


Fig. 7—Second Turning, Sand and Cement.

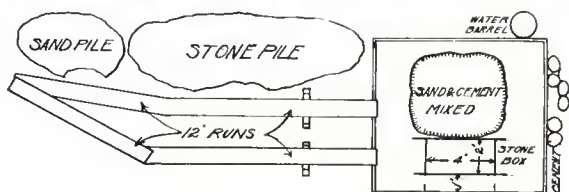


Fig. 8—Filling the Stone (or Gravel) Measuring Box—First Method.

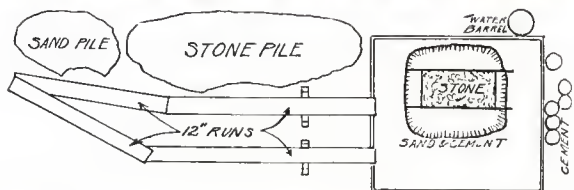
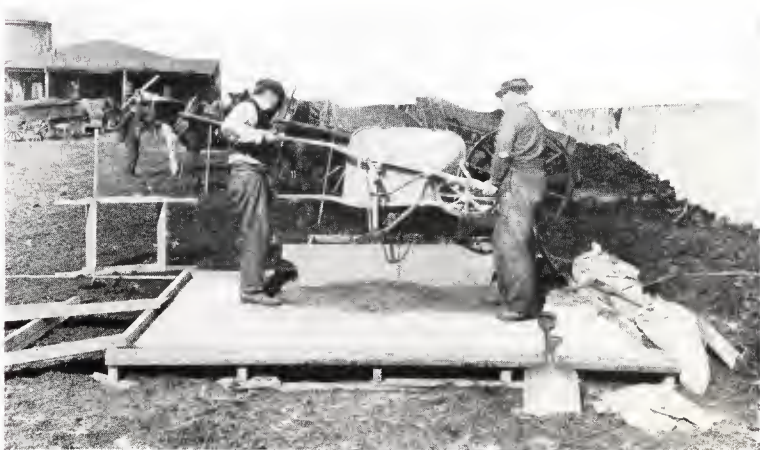


Fig. 9—Filling the Stone (or Gravel) Measuring Box when on Top of Mixed Sand and Cement—Second Method.



way the material is shoveled from one side of the board to the other, as shown in Figs. 6 and 7; Fig. 6 shows the first turning, and Fig. 7 the second turning.



Fig. 10—Placing the Water on the Stone (or Gravel) which is on Top of the Mixed Sand and Cement.



Fig. 11—Mixing the Stone (or Gravel) with the Sand and Cement.

The sand and cement should now be well mixed and ready for the stone and water. After the last turning, spread the sand and cement out carefully, place the gravel or stone measuring box be-

side it as shown in Fig. 8, and fill from the gravel pile. Lift off the box and shovel the gravel on top of the sand and cement, spreading it as evenly as possible. With some experience equally good results



Fig. 12—Concrete Mixed and Ready for Placing.



Fig. 13—Placing the Concrete with Wheelbarrows.

can be obtained by placing the gravel-measuring box on top of the carefully leveled sand and cement mixture, and filling it, thus placing the gravel on top without an extra shoveling. This method is shown in Fig. 9. Add about three-fourths the required amount

feet, as shown under "Tools." In this case start the mixing in the middle of the board, and each pair of men mixing exactly as if for a two-bag batch, except that the concrete is shoveled into one



Fig. 14—Screening the Sand from the Gravel in a Natural Mixture of Bank Sand and Gravel.

big mass each time it is turned back on to the center of the board. When more than four men are available, the balance may place the concrete, make new runs, load wheelbarrows, etc., taking the con-



Thus the necessary quantities of materials are:

54 barrels of Portland cement.

16½ cubic yards of sand.

31 cubic yards of stone or gravel.

It is always wise to order two or three extra barrels of cement if the dealer is at considerable distance, as this avoids any possible trouble that a shortage might cause. Besides, any cement left over always comes in handy for repair work around the house or barn.

## PLACING THE CONCRETE

**How PLACED.**—After the concrete is properly mixed it should be placed at once. Concrete may be handled and placed in any way best suited to the nature of the work, provided the materials do not separate in placing. Concrete may be properly placed by shoveling off the concrete board directly into the work, by shoveling into wheelbarrows (see Fig. 13), wheeling to place and dumping, by shoveling down an inclined chute, or by shoveling into buckets and hoisting into place. Concrete should be deposited in layers about 6 inches thick unless otherwise specified.

**CONSISTENCY.**—There are three kinds of mixtures used in general concrete work as follows:—

1. *Very Wet Mixture.*—Concrete wet enough to be mushy and run off a shovel when handling. Used for reinforced work, thin walls, or other thin sections, etc.; no ramming necessary.

2. *Medium Mixture.*—Concrete just wet enough to make it jelly-like. Used for some reinforced work, also foundations, floors, etc. Ramming with tamper or treading with feet necessary to remove air-bubbles and fill voids. See Fig. 12; this concrete is of a medium consistency, and a man would sink over his shoe-tops if he were to step on to the top of the pile.

3. *Dry Mixture.*—Concrete like damp earth: used for foundations, etc., where it is important to have the concrete set up as quickly as possible. This must be spread out in thin 4-inch to 6-inch layers in placing and thoroughly tamped until the water comes to the surface.

The proper mixture to use for a given operation will always be specified in the subsequent bulletins on construction. The difference between the mixtures is that the drier the mixture, the quicker the concrete sets up; in the end when carefully mixed and placed the results from any of the above mixtures would be the same. A dry mixture, however, cannot be used readily with reinforced steel, costs

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1. *Very Wet Mixture*.—Concrete wet enough to be mushy and run off a shovel when handling. Used for reinforced work, thin walls, or other thin sections, etc.; no ramming necessary.

2. *Medium Mixture*.—Concrete just wet enough to make it jelly-like. Used for some reinforced work, also foundations, floors, etc. Ramming with tamper or treading with feet necessary to remove air-bubbles and fill voids. See Fig. 12; this concrete is of a medium consistency, and a man would sink over his shoe-tops if he were to step on to the top of the pile.

3. *Dry Mixture*.—Concrete like damp earth: used for foundations, etc., where it is important to have the concrete set up as quickly as possible. This must be spread out in thin 4-inch to 6-inch layers in placing and thoroughly tamped until the water comes to the surface.

The proper mixture to use for a given operation will always be specified in the subsequent bulletins on construction. The difference between the mixtures is that the drier the mixture, the quicker the concrete sets up; in the end when carefully mixed and placed the results from any of the above mixtures would be the same. A dry mixture, however, cannot be used readily with reinforced steel, costs



more and is harder to handle, must be protected with greater care from the sun or from drying too quickly, and, lastly, is likely, unless "spaded" by most experienced hands, to show voids or stone (or gravel) pockets in the face of the work when the forms are removed.

SPADING.—Concrete of any of the three degrees of consistency mentioned above should be carefully "spaded" next to the form

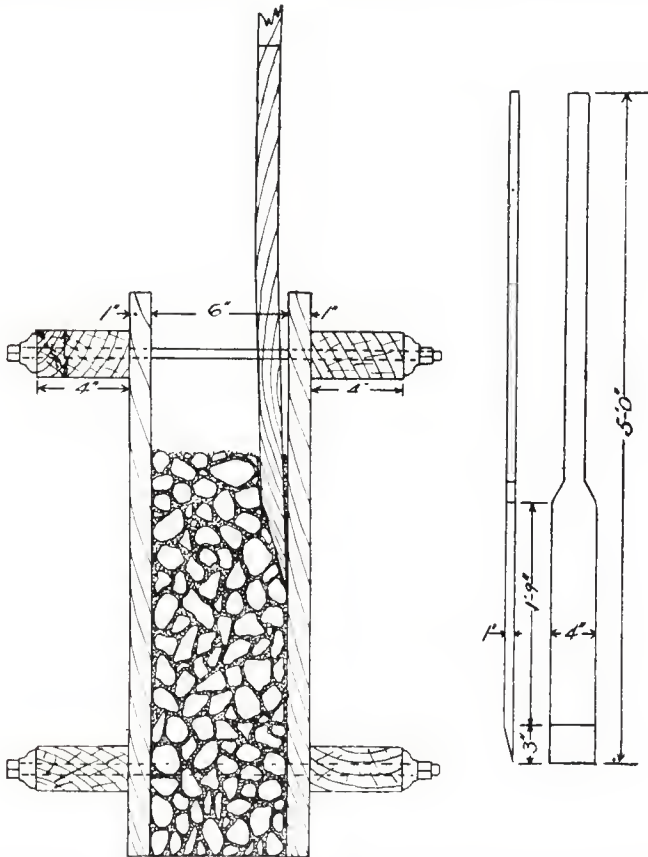


Fig. 15—Spading Thin 6-Inch Concrete Wall and Cut of Wooden Spading Tool.

where the finished concrete will be exposed to view. "Spading" consists of running a spade or flattened shovel down against the face of the form and working up or down. This action causes the

stone or gravel to be pushed back slightly from the form, and allows the cement grout to flow against the face of the form and fill any voids that might be there, thus making the face of the work present an even, homogeneous appearance. Where the narrowness of the concrete section, such as in a 6-inch silo wall, prevents the use of a spade, a 1-inch x 4-inch board, sharpened to chisel edge on the end, will do as well. Only sharpen on one side and place the flat side against the form as shown in illustration. (See Fig. 15.) In the case of a dry mixture, "spading" must be done with greatest care by experienced hands to get uniform results, but with a medium or wet mixture it is very easy to obtain first-class work; indeed, with a wet mixture spading is only required as an added precaution against the possibility of voids in the face of the work, and is really necessary in few cases.

**PROTECTION OF CONCRETE AFTER PLACING.**—Green concrete should not be exposed to the sun until after it has been allowed to set for five or six days. Each day during that period the concrete should be wet down by sprinkling water on it, both in the morning and afternoon. This is done so that the concrete on the outside will not dry out much faster than the concrete in the center of the mass, and should be carried out carefully, especially during the hot summer months. Old canvas, sheeting, burlap, etc., placed so as to hang an inch or so away from the face of the concrete will do very well as a protection. Wet this as well as the concrete. Often the concrete forms can be left in place a week or ten days; this protects the concrete during the setting-up period and the above precautions are then unnecessary.

**CLEANING THE CONCRETE BOARD.**—When the day's work is done, carefully clean all the tools, especially the concrete board. Remove with a shovel all the loose cement, sand, and stone. Then scrub the board with a broom and water. If this is not done, small particles of stone are glued to the board by the cement, and render shoveling the next day most difficult.

In closing, we again wish to call attention to the fact that there are several ways of buying cement, storing cement, and mixing concrete by hand, just as effective in their results as the ways mentioned here. But every man of experience in mixing has one way which he thinks as effective and easier than any other. The way described here is *our* easy way.

***Ask your dealer for "Chicago AA" Portland Cement. If he does not carry it in stock, write to the Chicago Portland Cement Co., 108 La Salle St., Chicago.***



